

# PATENT COOPERATION TREATY


## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 02 MAR 2005

WIPO PCT

Applicant's or agent's file reference <b>ACD 2992 WO</b>	<b>FOR FURTHER ACTION</b> <div style="text-align: right;">See Form PCT/PEA/416</div>	
International application No. <b>PCT/EP2004/003661</b>	International filing date (day/month/year) <b>02.04.2004</b>	Priority date (day/month/year) <b>14.04.2003</b>
International Patent Classification (IPC) or national classification and IPC <b>C08F12/08</b>		
Applicant <b>AKZO NOBEL N.V.</b>		
<ol style="list-style-type: none"> <li>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</li> <li>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</li> <li>3. This report is also accompanied by ANNEXES, comprising:               <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:                   <div style="margin-left: 20px;"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).                   <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.                 </div> </li> <li>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</li> </ol> </li> </ol>		
<ol style="list-style-type: none"> <li>4. This report contains indications relating to the following items:               <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion  <input type="checkbox"/> Box No. II Priority  <input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  <input checked="" type="checkbox"/> Box No. IV Lack of unity of invention  <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement  <input type="checkbox"/> Box No. VI Certain documents cited  <input type="checkbox"/> Box No. VII Certain defects in the international application  <input type="checkbox"/> Box No. VIII Certain observations on the international application             </div> </li> </ol>		
Date of submission of the demand  <b>01.11.2004</b>	Date of completion of this report  <b>03.03.2005</b>	
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  <b>Hammond, A</b>  Telephone No. +31 70 340-4253	



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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-19 as originally filed

**Claims, Numbers**

1-13 received on 13.01.2005 with letter of 13.01.2005

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

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1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 12-13

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 12-13

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

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**Box No. IV Lack of unity of invention**

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1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☒ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-11 .

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-11
Inventive step (IS)	Yes: Claims	
	No: Claims	1-11
Industrial applicability (IA)	Yes: Claims	1-11
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item I**

**Basis of the opinion**

1.(a) The present opinion is based on the application claims 1-11 (see Items IV and V below).

(b) It is noted that the amended claims as filed on 13/1/05, and particularly amended claim 1, claim a polymerisation process in which the dosing of the initiator is conducted "from the point in time at which none of the monomer has been polymerised until "at least 70%" of all the monomer is polymerized," i.e. the dosing of initiator as claimed in the said application claim can be conducted at any point after none of the monomer has been polymerised (as the application claim 1's use of the phrase "at least 70%" does not give any upper limitation at 70%, and thus does not exclude any such higher percentages).

**Re Item IV**

**Lacks of unity of invention**

In consideration that the original unamended application claims, and particularly claim 1, relating to an "essentially vinyl chloride free" suspension polymerisation process for polymerising styrene monomer as described in the said claim 1, are not considered to be novel and inventive (see Item V below and the lack of unity sheet B attached to the original search report), the original application contains several lacks of unity according to Rule 13.1 PCT.

The applicant was originally invited to either restrict the application claims or pay additional fees for the further inventions relating to the said lack of unity.

The applicant decided not to pay the additional fees and consequently the substantive examination has been based on the first invention only, relating to original application claims 1-11.

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanationssupporting such statement.**

1. (a) The following documents are cited in the present opinion. The numbering will be adhered to during the rest of the proceedings :

D1 US5189069

D2 US4363881  
D3 GB1086591  
D4 WO0214393  
D5 US5905096  
D6 WO0017245

(b) The Examining Division again notes the consideration made in the above Item I, point (b) - particularly regarding the application's use of the phrase "at least 70%".

2. D1 is considered to disclose an "essentially vinyl chloride-free" suspension polymerisation process for polymerising styrene monomer, or a mixture of monomers comprising styrene, comprising the step of continuously or semi-continuously dosing an initiator, or a mixture of initiators, from the point in time at which none of the monomer has been polymerised until at least 70% of all monomers is polymerised, to the reaction mixture at the polymerisation temperature, characterised in that at least one initiator that is dosed has a half-life of 60 minutes or less at said polymerisation temperature. It is considered that the present application claim 1's use of the phrase, "essentially vinyl chloride-free" does not exclude the presence of vinyl chloride. It is further considered that present application claim 1's use of this said phrase results in a lack of clarity (Article 6 PCT) as there is no clear quantification in claim 1 leading to a lack of a clear and objective definition of the claimed subject-matter.

The disclosures of D1 (abstract ; claim 1 ; column 2, line 20-32 ; column 3, line 33-37, 48-66 "di-tert-butyl peroxide etc.) are considered to be novelty-attacking for the subject-matter of the present claims 1-11 (Article 33(2) PCT).

On the basis of the information / proven experimental evidence presently on file, D2-D6 are also considered to be novelty-attacking for the subject-matter of the present claims : The disclosures of D2 (claims 9-15 ; column 3, line 16-21, 29-32, 41-59 ; column 4, line 25-28) are considered to be novelty-attacking for the subject-matter of the present claims 1-5,7-11 (Article 33(2) PCT).

The disclosures of D3 (claims 1-4 ; example 5 ; page 2, line 83-90 ; page 2, line 17-64) are considered to be novelty-attacking for the subject-matter of the present claims 1-7,9 (Article 33(2) PCT).

The disclosures of D4 (claims 5, 1-4 ; page 5, line 13-18 ; page 4, line 23-29 ; abstract ;

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page 3, line 3 - page 4, line 2) are considered to be novelty-attacking for the subject-matter of the present claims 1-7,9,10 (Article 33(2) PCT).

The disclosures of D5 (example 1 ; claims 1-10 ; column 2, line 13 - column 3, line 6) are considered to be novelty-attacking for the subject-matter of the present claims 1-11 (Article 33(2) PCT).

The disclosures of D6 (abstract ; page 2, line 11-16 ; page 3, line 12 - page 6, line 13 ; page 2, line 24 "styrene") are considered to be novelty-attacking for the subject-matter of the present claims 1-10 (Article 33(2) PCT).

## CLAIMS

1. An essentially vinyl chloride-free suspension polymerization process for polymerizing styrene monomer, or a mixture of monomers comprising styrene, comprising the step of continuously or semi-continuously dosing an initiator selected from the group consisting of peroxydicarbonates, peroxyarbonates, peroxyesters, peroxyketals, diacylperoxides, dialkylperoxides, azo-initiators, ketone peroxides, which initiators may be functionalized, and mixtures thereof, from the point in time at which none of the monomer has been polymerized until at least 70% of all the monomer is polymerized, to the reaction mixture at the polymerization temperature, wherein at least one initiator that is dosed has a half-life of 60 minutes or less at said polymerization temperature.
2. Process according to claim 1 wherein the composition further comprises co-monomers selected from the group consisting of vinyl acetate, ethylene, propylene, acrylonitrile, butadiene, (meth)acrylates, and ethylenically unsaturated polymers, such as polybutadiene and styrene butadiene rubber.
3. Process according to claim 1 or 2 wherein said initiator is dosed continuously or semi-continuously from the point in time at which at least 0.1%, more preferably at least 0.5%, most preferably 1% of the monomer has already been polymerized until at least 70%, preferably at least 80%, more preferably at least 90%, and most preferably essentially all of the monomer is polymerized, the term "essentially all of the monomer is polymerized" meaning that less than 1,000 ppm of monomer is present in the final polymerized product.
4. Process according to any one of claims 1-3 wherein the initiator is selected from the group consisting of substituted, or unsubstituted, dibenzoylperoxides, 1,1-di(tert-butylperoxy)-3,3,5-trimethylcyclohexane, 2,2-di(tert-butylperoxy)butane, 1,1-di(tert-

butylperoxy)cyclohexane, azo initiators, and mixtures thereof, most preferably from dibenzoylperoxide, 1,1-di(tert-butylperoxy)-3,3,5-trimethylcyclohexane, 2,2'-azobis(isobutyronitrile), 2,2'-azobis(2-methylbutyronitrile), and mixtures thereof.

5. Process according to any one of claims 1-4 wherein the reaction temperature is 170°C or lower, preferably 150°C or lower, more preferably 130°C or lower, and most preferably 120°C or lower.
6. Process according to any one of claims 1-5 wherein at least part of the initiator is continuously or semi-continuously dosed over a period of at least 0.5 hour, preferably at least 1 hour.
7. Process according to any one of claims 1-6 wherein at least 0.01 wt.%, more preferably at least 0.05 wt.%, and most preferably at least 0.1 wt.% of the combined weight of all initiators and preferably at most 5 wt.%, more preferably at most 3 wt.%, and most preferably at most 1 wt.% of the combined weight of all initiators, based on the weight of the monomers to be polymerized, is used.
8. Process according to any one of claims 1-7 wherein a blowing agent is added or dosed to the reaction mixture when the degree of polymerization of the monomer is less than 80%, preferably less than 60%, and most preferably less than 50%.
9. Process according to any one of claims 1-8 wherein the initiator, or mixture of initiators, is dosed in the form of a, preferably aqueous, dispersion.
10. Process according to any one of claims 1-9 wherein an additional initiator is used to reduce the residual monomer level.

11. Process according to claim 10 for the preparation of expandable polystyrene.
12. Styrene based (co)polymer obtainable by a process according to any one of claims 1-11, wherein the styrene based (co)polymer has less than 50 ppm of residual initiator, more preferably less than 40 ppm, and most preferably less than 25 ppm of initiator, immediately after drying for 1 hour at 60°C and screening.
13. Use of a styrene (co)polymer according to claim 12 in a shaping process involving the heating of the co(polymer) for the preparation of foamed articles.